

Orbits of the Saturnian Satellites from Earthbased and Voyager Observations

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I have redetermined the orbits of sixteen of the Saturnian satellites (Phoebe and Pan have been excluded) using Earthbased astrometric observations (1966 to 1994), Voyager imaging observations, and Hubble Space Telescope observations (1995). These orbits provide an update to those previously reported by Jacobson and Vaughan (1993, Bull. AAS 25, 1234) and Jacobson (1995, Bull. AAS 27, 1202). Some of the features of the new determination include: the use of a J2000 reference system for the minor satellites; the addition of Earthbased observations from 1990 through 1994; the incorporation of a set of a high quality HST observations from the 1995 Saturn Ring Plane Crossing time period; the use of the Voyager observations of the major satellites. As the first joint determination of the orbits of the major and minor satellites, the work also took advantage of a number of relative observations involving such bodies. This was especially true for the Voyager observations in which numerous images contain both major and minor satellites. The RMS of the postfit residuals of the various astrometric datasets, processed in the form of relative positions, ranged from $0''.11$ to $0''.50$. For the La Palma CCD observations the RMS was $0''.09$, and for the HST observations it was $0''.08$. The Voyager images were fit to between 0.25 and 0.75 pixels.

In its new orbit Mimas has moved about 41 of) km ahead of where it was in the earlier one, i.e. it is about 5 minutes early. Enceladus has moved about 1500 km back or about 2 minutes late.

As a byproduct of the orbit update I have obtained revised masses for Tethys and Dione. The new values (km^3/sec^2) are, respectively, 41.81 ± 0.30 , and 73.163 ± 0.10 . They are influenced 10% by the additional observations and reflect the direct effects on the Lagrangian satellites as well as the resonances with Mimas and Enceladus.

This work was performed to support the Cassini Project and the reduction of observations obtained during the 1995 Saturn Ring Plane Crossing.

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